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(54) **Battery pack.**

(57) The battery pack includes hollow tubular-shaped anodic and cathodic terminals (resp. 4,5) in a right upper void (10) and in a left upper void (11), respectively, of the battery casing (1). The voids are produced by housing the cylindrical first and second secondary batteries (2,3) in the battery casing. An anodic terminal connecting pin (4) and a cathodic terminal connecting pin (5) are provided on an external equipment for fitting in and connecting with the anodic terminal and the cathodic terminal, respectively. Since there is no necessity for providing a particular mounting space for the anodic and cathodic terminals, the battery pack may be reduced in size, while the battery pack may be reliably supported with respect to the external equipment in a manner free from wobbling or detachment from the external equipment.

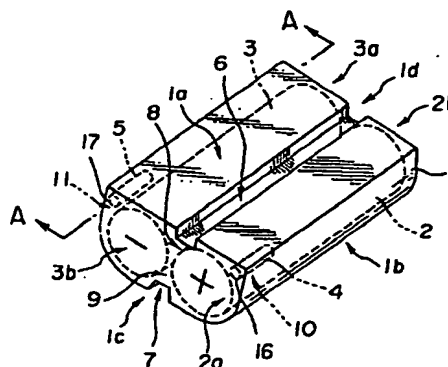


FIG. 2

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BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a battery pack having a rechargeable secondary battery housed within a battery casing. More particularly, it relates to a battery pack employed for supplying power to portable electronic equipment, such as a portable video camera unit.

Description of the Related Art

There is extensively employed a so-called handy-type video camera unit which is able to record moving pictures easily on, for example, an 8 mm wide video tape. Since this handy type video camera is lightweight, small-sized and can be transported easily, a battery pack having a so-called secondary battery housed therein is typically used as a power source.

A conventional battery pack, as shown for example in Fig. 1, is made up of a substantially rectangular battery casing 50, first to fifth rechargeable secondary batteries 51a to 51e accommodated in the battery casing 50, an anodic plate 52 connected to an anode of the first secondary battery 51a for use as an anode terminal, and a cathodic plate 53 connected to the cathode of the fifth secondary battery 51e for use as a cathode terminal.

The battery casing 50 has a substantially planar junction surface 50a by which the battery casing is to be connected to a power supply surface of a video camera unit or a charger. On the junction surface 50a are formed a cavity for anodic terminal 54 and a cavity for cathodic terminal 55 at a predetermined interval from each other. Within these cavities 54 and 55, which are preferably elliptical in shape, the anodic plate 52 and the cathodic plate 53 are provided for closing them from the back side of the junction surface 50a.

The first to fifth secondary batteries 51a to 51e are substantially cylindrical in shape and are each of a length slightly shorter than the transverse width of the battery casing 50. The secondary batteries 51a to 51e are transversely arrayed in the battery casing 50 so that the anodes and the cathodes are alternately directed in the opposite directions, as shown by broken lines in Fig. 1. Within the battery casing 50, the first secondary battery 51a has its cathode connected to the anode of the second secondary battery 51b by a connecting plate (not shown), the second secondary battery 51b has its cathode connected to the anode of the third secondary battery 51c by a connecting plate 56, the third secondary battery 51c has its cathode connected to the anode of the fourth secondary battery 51d by a connecting plate (not shown), and the fourth secondary battery 51d has its cathode connected to the anode of the fifth secondary battery

51e by a connecting plate 57. That is, the first to fifth secondary batteries 51a to 51e are connected in series with one another so that the anode of the first secondary battery 51a is connected to the anodic plate 52 and the cathode of the fifth secondary battery 51e is connected to the cathodic plate 53.

Meanwhile, the upper surface 50b of the battery casing 50 opposite to the junction surface 50a has its four corners 50c rounded to facilitate handling because these corners are caused to abut on the palm of the hand of the user when connecting the battery pack to the power supply surface of the video camera unit or the charger.

The power supply surface of the video camera unit or the charger is provided with an anode contacting pin and a cathode contacting pin which are contacted at their upper ends with the anodic plate 52 and the cathodic plate 53, respectively, when the power supply surface is connected to the junction surface 50a of the battery pack.

During charging, there are stored in the battery pack the electrical energies supplied from the charger by way of the anode contacting pin, cathode contacting pin, anodic plate 52 and the cathodic plate 53 in this order. Conversely, during discharging, the electrical energies stored in the battery pack by charging are supplied to the video camera unit by way of the anodic plate 52, cathodic plate 53, anode contacting pin and the cathode contacting pin in this order.

With the above-described battery pack, since the special mounting space is provided in the junction surface 50a for the anodic terminal and the cathodic terminal, that is, the anodic plate 52 and the cathodic plate 53, the battery pack itself is increased in size in an amount corresponding to the mounting space for the anodic and cathodic terminals to retrogress from the goal of reducing the size of the video camera unit.

On the other hand, since the anodic terminal and the cathodic terminal are plate-shaped and contacted by the upper ends of the anodic contact pin and the cathodic contact pin provided on the charger or on the video camera unit for charging or discharging electrical energies, the anodic contact pin or the cathodic contact pin cannot be contacted reliably with the anodic terminal or with the cathodic terminal, respectively, thus leading to contact troubles. Besides, since the plate-shaped surface is contacted with the contact pins, the battery pack cannot be supported reliably by the charger or by the video camera unit, thus leading to wobbling of the battery pack during use or to the battery pack being detached from the charger or from the video camera unit.

OBJECTS AND SUMMARY OF THE INVENTION

In view of the above-described status of the art, it is an object of the present invention to provide a battery pack in which the anodic terminal and the cath-

odic terminal can be mounted without providing a special mounting space and the anodic terminal or the cathodic terminal can be contacted reliably with connecting pins of the charger or the electronic equipment, such as a video camera unit, and which is free from the risk of being wobbled or detached from the equipment when in use.

According to the present invention, there is provided a battery pack having at least one re-chargeable secondary battery housed within a battery casing, comprising a substantially tubular-shaped anodic terminal, a substantially tubular-shaped cathodic terminal, said secondary battery being adapted for storing electrical energies supplied thereto via said anodic terminal and said cathodic terminal and for outputting the stored electrical energies via said anodic terminal and said cathodic terminal, and a battery casing for housing the secondary battery therein, said substantially tubular-shaped anodic and cathodic terminals being provided in voids produced on housing said secondary battery in said battery casing.

With the present battery pack, by providing the substantially tubular-shaped anodic and cathodic terminals in the voids produced on housing the secondary batteries in the battery casing, the mounting space for the anodic and cathodic terminals may be diminished. Furthermore, the substantially tubular-shaped anodic and cathodic terminals of the battery casing may be connected reliably to the connecting pins of the equipment, such as the video camera unit, for assuring a positive support of the battery pack by the external equipment.

Other objects and advantages of the present invention will become apparent from the following description of the preferred embodiment and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing a conventional battery pack.

Fig. 2 is a perspective view showing a battery pack embodying the present invention.

Fig. 3 is a front view showing the battery pack shown in Fig. 2.

Fig. 4 is a longitudinal cross-sectional side view, taken along line A-A of Fig. 2, showing the battery pack.

Fig. 5 is a plan view showing the battery pack shown in Fig. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, a battery pack according to a preferred embodiment of the present invention will be explained in detail.

The battery pack according to the present invention comprises a substantially rectangular battery

casing 1, first and second rechargeable secondary batteries 2, 3 accommodated in the battery casing 1, an anodic terminal 4 connected to an anode 2a of the first secondary battery 2, and a cathodic terminal 5 connected to a cathode 3b of the second secondary battery 3.

The first and second secondary batteries 2, 3 are cylindrical-shaped and are each of a length slightly shorter than the length of the battery casing 1. On the other hand, the combined length of the diameter of the first secondary battery 2 and the diameter of the second secondary battery 3 is slightly shorter than the transverse width of the battery casing 1, while the diameter of each of the first and second secondary batteries 2, 3 is slightly lower than the height of the battery casing 1. Consequently, the first and second batteries 2, 3 are accommodated in the battery casing 1 with a certain looseness. Meanwhile, the first and second secondary batteries 2, 3 are accommodated in the battery casing 1 so that the anode 2a of the first secondary battery 2 and the cathode 3a of the second secondary battery 3 face the front side 1c of the battery casing 1. In this state, the cathode 2b of the first secondary battery 2 and the anode 3a of the second secondary battery 3 are connected to each other by a connecting plate (not shown). That is, the first secondary battery 2 and the second secondary battery 3 are connected in series with each other. Also, the batteries 2, 3 are contacted side to side when accommodated in the battery casing 1.

Since the batteries 2, 3 are contacted side to side when accommodated in the substantially rectangular battery casing 1, as described above, a first central gap 8 is defined on an upper surface 1a of the battery casing 1. By taking advantage of the first central gap 8, a guide groove 6 having a rectangular transverse cross-section is defined beginning from the mid part of the front side 1c and extending along the overall length of the battery casing 1. Similarly, a second central gap 9 is defined on a lower surface 1b of the battery casing 1 as a result of the batteries 2, 3 being contacted side to side. By taking advantage of the second central gap 9, an inverted insertion inhibiting groove 7 having a trapezoidal transverse cross-section is defined beginning from the mid part of the front side 1c and extending for a length equal to about two-thirds of the length of the guide groove 6, or to a mid part of the length of the battery pack.

The lower surface 1b of the battery pack 1 has its corners rounded for ease of handling. Consequently, the battery casing 1 has the shape of a barrel roof, when viewed from the front side 1c, as shown in Fig. 3.

The anodic terminal 4 is cylindrical-shaped and connected to the anode 2a of the first secondary battery 2, while the cathodic terminal 5 is similarly cylindrical-shaped and connected to the cathode 3b of

the second secondary battery 3.

When the first and second secondary batteries 2, 3 are housed within the battery casing 1, since the battery casing is barrel roof shaped, a right upper void 10 is defined between the first secondary battery 2 and the right upper corner of the battery casing 1 as viewed from the front side 1c, while a left upper void 11 is defined between the second secondary battery and the left upper corner of the battery casing 1 as viewed from the front side 1c, in addition to the first and second central voids 8, 9, as shown in Fig. 3. An anode insertion hole 16 and a cathode insertion hole 17, slightly larger in diameter than and approximately equal in length to the anodic terminal 4 and the cathodic terminal 5, respectively, are provided in the right upper gap 10 and in the left upper gap 11 in parallel relationship to the first secondary battery 2 and the second secondary battery 3, respectively. The anodic terminal 4 and the cathodic terminal 5 are inserted into the anode insertion hole 16 and into the cathode insertion hole 17, respectively.

Meanwhile, the battery casing 1 is molded, along with the anode insertion hole 16 and the cathode insertion hole 17, from an insulating material, so that, by inserting the anodic terminal 4 and the cathodic terminal 5 into the anode insertion hole 16 and into the cathode insertion hole 17, respectively, it becomes possible to prevent short-circuiting which might occur due to the anodic terminal 4 and the cathodic terminal 5 being contacted with the first secondary battery 2 and the second secondary battery 3, respectively.

By providing the hollow cylindrical-shaped anodic and cathodic terminals 4 and 5 in the right upper void 10 and in the left upper void 11, respectively, which are produced as a result of the first and second secondary batteries 2, 3 being accommodated within the battery casing 1, it is no longer necessary to provide a particular mounting site for mounting the anodic terminal 4 or the cathodic terminal 5, thus enabling the battery pack to be reduced in size and contributing to reduction in size of the charger or the electronic equipment, such as a video camera unit, which is to be connected to the battery pack.

The video camera unit, for example, to which the battery pack having such cylindrical-shaped anodic and cathodic terminals 4, 5 is connected, may be of an external attachment type in which the battery pack is attached to the outer side of the video camera unit. However, by providing a battery pack housing section within the video camera unit, and by housing the battery pack within the battery pack housing section for establishing electrical connection, in accordance with an internal mounting system, the anodic terminal 4 and the cathodic terminal 5 may be connected more reliably to the connecting pins, while the battery pack may be supported more reliably by the unit.

If the internal mounting system is adopted, as in

the case of the external attachment system, an anode connecting pin and a cathode connecting pin, each having a diameter slightly smaller than the inside diameter of the anodic terminal 4 and the cathodic terminal 5 respectively, and adapted for being engaged with the anodic terminal 4 and the cathodic terminal 5, respectively, are protuberantly formed at a terminal end of the battery pack housing section provided in the video camera unit at an interval corresponding to the interval by which the anodic terminal 4 and the cathodic terminal 5 are provided on the battery casing 1. The distal ends of the anodic connecting pin and the cathodic connecting pin are tapered for ease of insertion into the anodic terminal 4 and into the cathodic terminal 5, respectively.

At an inserting end of the battery pack housing section are formed a first protrusion of a rectangular transverse cross-section and a second protrusion of a trapezoidal transverse cross-section. The first and second protrusions are provided for being engaged with the guide groove 6 of the upper surface 1a of the battery casing 1 and the inverted insertion inhibiting groove 7 of the lower surface 1b of the battery casing 1, respectively, when the battery casing 1 is introduced into the battery casing housing section.

The inverted insertion inhibiting groove 7 of the battery casing 1 is trapezoidal in transverse cross-section, and the second protrusion provided at the inserting end of the battery pack housing section of the video camera unit is also trapezoidal in transverse cross-section, so that, if it is attempted to introduce the battery pack in an upside-down position into the battery pack housing section, the inverted insertion inhibiting groove 7 and the second protrusion cannot be fitted, so that insertion cannot be achieved. On the other hand, if it is attempted to introduce the battery pack with the rear side first, since the inverted insertion inhibiting groove 7 is not formed throughout the entire length of the battery casing 1, the second protrusion is engaged with the back side 1d of the battery casing 1, so that insertion similarly cannot be achieved. In this manner, by providing the inverted insertion inhibiting groove of the trapezoidal transverse cross-section having the length shorter than the overall length of the battery casing 1 from the front side 1c of the battery casing 1, insertion of the battery pack in the upside down position or with the rear side of the battery pack first can be prevented.

If the battery pack is introduced in the correct vertical position and in the correct fore-and-aft position into the battery pack housing section, the guide groove 6 of the rectangular transverse cross-section is engaged by the first protrusion of the rectangular transverse cross-section which is provided at the entrance to the battery pack housing section of the electronic equipment, such as a video camera unit, so that the battery pack is guided by the guide groove 6 into the battery pack housing section. Thus, as shown in

Fig.4 which is the longitudinal cross-section along line A-A of Fig. 2, the anodic connecting pin 13 provided at the terminal part of the battery pack housing section is connected to the cathodic terminal 5 of the battery pack 1, while the anodic connecting pin is inserted into and connected to the anodic terminal 4, in a manner not shown.

Since the anodic connecting pin and the cathodic connecting pin 13 are fitted and connected to the anodic terminal 4 and to the cathodic terminal 5, respectively, the battery pack may be supported reliably by the anodic connecting pin and the cathodic connecting pin. Consequently, when the battery pack is inserted into the battery pack housing section for electrical connection at the anode and the cathode, the battery pack may be prevented from being wobbled or detached from the video camera unit.

Meanwhile, since the anodic terminal 4 and the cathodic terminal 5, provided in the battery pack, are cylindrical-shaped, and hence hollow, the hollow part tends to be clogged with foreign matter, such as dust. If the above-described connection is made with the foreign matter clogged in the hollow part, the foreign matter is forced into the terminals 4 and 5 by the connecting pins and may cause contact troubles. For this reason, dust eliminating holes 14, 15 are provided through the anodic terminal 4 and the cathodic terminal 5, respectively, as shown in Figs.4 and 5. Thus, the dust clogged in the anodic terminal 4 and in the cathodic terminal 5 is extruded via the elimination holes 14, 15 by the connecting pins to maintain the anodic terminal 4 and the cathodic terminal 5 clean at all times to prevent the contact troubles.

It is seen from the above description that the present invention provides a battery pack in which the cylindrical-shaped anodic and cathodic terminals 4 and 5 are mounted in the right upper void 10 and in the left upper void 11 produced by housing the first and second secondary batteries 2, 3 in the battery casing 1, so that there is no necessity of providing a particular mounting space for the anodic terminal 4 or the cathodic terminal 5. This arrangement renders it possible to reduce the size of the battery pack to contribute to reduction in size of the charger or the video camera unit.

On the other hand, since the anodic terminal 4 and the cathodic terminal 5 are fitted and connected to the anodic connecting pin and to the cathodic connecting pin provided in the equipment, respectively, the battery pack can be supported reliably by the anodic and cathodic connecting pins to eliminate wobbling or detachment of the battery pack.

Although first and second secondary batteries are housed within the battery casing 1 in the above-described embodiment, one or three or more of the secondary batteries may be accommodated in the battery casing 1 without departing from the scope of the present invention. Furthermore, although the

anodic and cathodic terminals are cylindrical in shape in the above-described embodiment, the anodic and cathodic terminals may be of any other shape, such as a polygon or an ellipse.

Claims

1. A battery pack having at least one re-chargeable secondary battery (2,3) housed within a battery casing (1), comprising:
 - a substantially tubular-shaped anodic terminal (4);
 - a substantially tubular-shaped cathodic terminal (5);
 - said secondary battery being adapted for storing electrical energies supplied thereto via said anodic terminal and said cathodic terminal and for outputting the stored electrical energies via said anodic terminal and said cathodic terminal; and a battery casing for housing said at least one secondary battery therein;
 - wherein said substantially tubular-shaped anodic and cathodic terminals are each provided within said battery casing in voids (10,11) produced by housing said secondary battery in said battery casing.
2. The battery pack as claimed in claim 1 wherein said at least one secondary battery (2,3) has the shape of a cylinder the axis of which is parallel to the axes of the substantially tubular-shaped anodic and cathodic terminals (4,5).
3. The battery pack as claimed in claim 1 wherein plural secondary batteries (2,3) are provided in parallel relation to one another in said battery casing (1).
4. The battery pack as claimed in claim 3 wherein said battery casing (1) has a guide groove (6) which is operative during attachment of the battery pack to an outside equipment, said guide groove being formed in the battery casing so as to be positioned in a void (8) between the plural secondary batteries (2,3).
5. The battery pack as claimed in claim 4 wherein said guide groove (6) extends the overall length of the battery pack.
6. The battery pack as claimed in claim 3 further comprising an inverted insertion inhibiting groove (7) for guiding the battery pack in the correct vertical position and in the fore-and-aft position during attachment of the battery pack to an outside equipment, said insertion inhibiting groove being formed in said battery casing (1) in a void

(9) between the plural secondary batteries (2,3).

7. The battery pack as claimed in claim 6 wherein said inverted insertion inhibiting groove (7) extends from a terminal end (1c) of said battery casing to a mid part of the length of the battery pack. 5
8. The battery pack as claimed in claim 3 further comprising a guide groove (6) which is to be used during attachment of the battery pack to an outside equipment and an inverted insertion inhibiting groove (7) for guiding the battery pack in the correct vertical position and in the correct fore-and-aft position during attachment of the battery pack to the outside equipment are formed in said battery casing in a void portion (resp. 8,9) between the plural secondary batteries (2,3). 10 15
9. The battery pack as claimed in claim 8 wherein said guide groove (6) and said inverted insertion inhibiting groove (9) are formed on opposite surfaces of said battery casing (1). 20
10. The battery pack as claimed in claim 2 wherein said substantially tubular-shaped anodic and cathodic terminals (4,5) are fixedly inserted into an anode inserting hole and a cathode inserting hole, respectively, formed in said battery casing (1). 25 30
11. The battery pack as claimed in claim 10 wherein dust eliminating holes (14,15) are formed between the lateral side of the battery casing and the recessed ends of said anode inserting hole and said cathode inserting hole for allowing dust collected in said anodic terminal (4) and said cathodic terminal (5) to be eliminated therefrom. 35 40 45 50 55 6

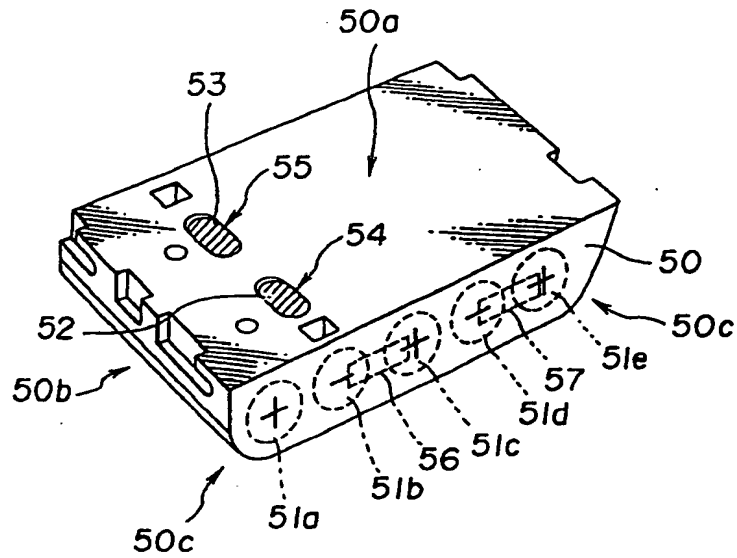


FIG. 1
(PRIOR ART)

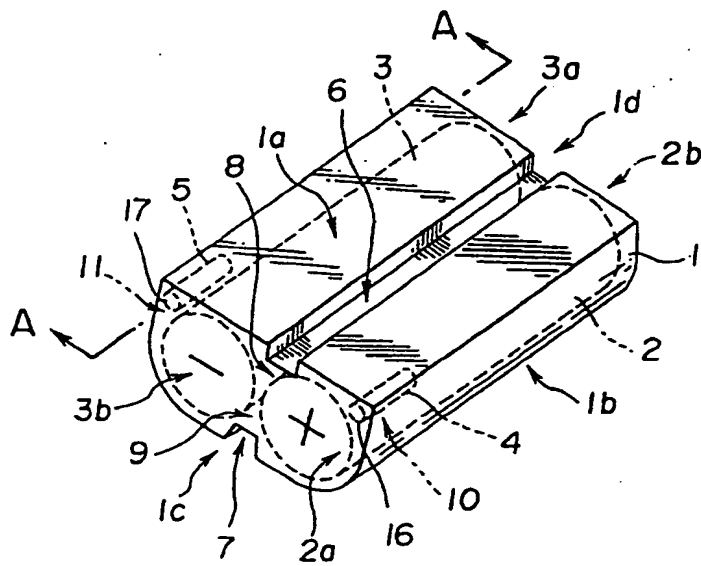


FIG. 2

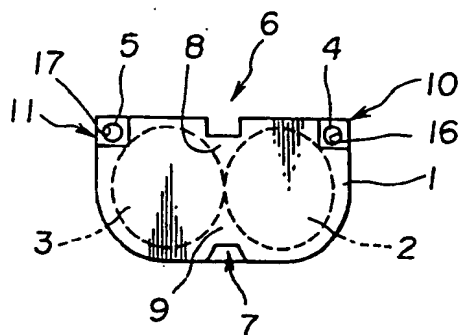


FIG. 3

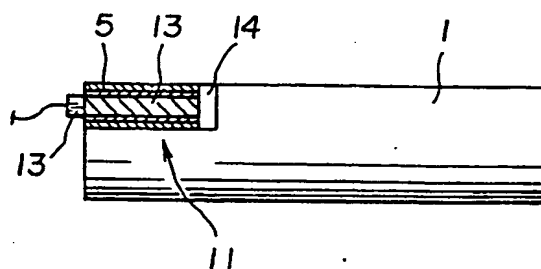


FIG. 4

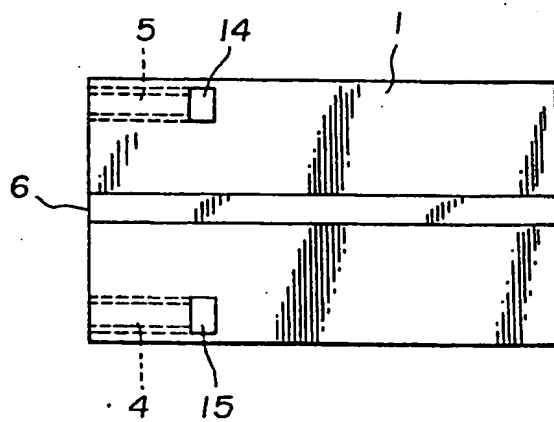


FIG. 5



European Patent
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EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 93400571.1
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB - A - 1 487 604 (MABUCHI MOTOR) * Fig. 1-5, 7 *	1, 2, 3	H 01 M 2/10 H 01 M 2/20 H 01 M 10/00
A	US - A - 4 997 731 (MACHIDA et al.) * Fig. 6, 16-18 *	1-5	
A	US - A - 4 576 880 (VERDIER et al.) * Abstract *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H 01 M
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 27-05-1993	Examiner LUX
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